

to the determination of the characters of minerals. He rightly believes that, while a careful study of the variety of specimens contained in a large mineral collection is most helpful towards acquiring facility in recognising mineral species, yet it is always desirable to be able to confirm a judgment by, or even to base it wholly upon, a few well-chosen tests, and this book is intended to assist students and others who may have occasion to identify mineral specimens in carrying out such tests.

The opening chapter deals with the goniometrical measurement and the perspective drawing of crystals, the calculation of the fundamental morphological data, and the measurement of refractive indices by the method of minimum deviation. In the next chapter the author passes on to the chemical examination by means of the blow-pipe, microchemical reactions, and the quantitative determination of the precious metals, coal, &c. The third chapter is concerned with crystal optics, and the fourth with the special application of these properties to use with the microscope. The last chapter includes the remaining physical characters, such as hardness, specific gravity, pyroelectricity, etching, melting point, and crystallisation, the phenomena presented by mixed crystals being considered at some length. In an appendix the author offers some hints on the kind of apparatus useful for prospectors and generally travellers interested in minerals, and considers the special case of precious stones.

The book has been carefully written, the hints given being evidently based upon the author's own experience, and it will be found to serve well the purpose for which it is intended.

*Mikrographie des Holzes der auf Java vorkommenden Baumarten*, im Auftrage des Kolonial-Ministeriums, unter Leitung von Prof. J. W. Moll, bearbeitet von H. H. Janssonius. Dritte Lieferung. Pp. 161-540. (Leiden: E. J. Brill, 1911.)

THIS is the third part of an extensive publication, designed to take advantage of a large number of Javanese wood specimens collected by Koorders with a view to the preparation of a forest flora for Buitenzorg. The collection is unique because corresponding herbarium material was gathered at the same time, so that the identity of each specimen can be accurately determined. The herbarium material was critically examined and described in the "Additamenta" noted in the title. The microscopic investigation is being conducted by Mr. H. H. Janssonius in great detail; a "topographical" or general description of the sections which would serve for most purposes is not considered sufficient, but copious details are supplied for each type of cell represented. Figures are only given for one species of each genus, and the scale of 1:25 is adopted; it would have expedited reference if a figure had been provided for each species on a scale of 1:10, enabling direct comparison to be made with illustrations provided in several standard works. The most valuable feature is the summary of anatomical characters drawn up for the analytical determination of genera and species. Prof. Moll suggested, in a notice of the earlier parts subscribed to the *Botanische Centralblatt* (vol. cxiii.), that it should be possible to determine not only the families but genera, and occasionally species, by the characters of the wood; the full consummation of this scheme is reserved for a final survey.

A book on these lines has long been a desideratum. Some estimation of the magnitude of the work can be formed when it is mentioned that this part completes a second volume of 540 pages, devoted entirely to the Discifloræ represented by 163 species or varieties.

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*When Should a Child Begin School? An Inquiry into the Relation between the Age of Entry and School Progress.* By W. A. Winch. Pp. iii+98. (Baltimore: Warwick and York, Inc., 1911.)

MR. WINCH's book is an admirable example of educational inquiry as it should be pursued. Instead of arguing on *a priori* grounds that children under five are better at home than at school, he shows by careful statistical methods what the actual effect of early entrance upon school courses is. His research shows in a thoroughly convincing way that those who begin school about five years of age do quite as well—often very much better—than those who begin at an earlier age. Stated quite moderately, it is clear that it makes no actual difference to the future school record whether a child begins at three or at five, though incidentally the figures suggest that delay beyond the fifth year is actually disadvantageous—a point in favour of English as opposed to German practice. Of course, many school authorities have already ceased to provide for children so young, not because of Mr. Winch's work, but because the State has withdrawn the grants. Yet it does not follow, of course, that the social value of the babies' classes in the infants' schools is nil. It is something that overworked wives are relieved for a few hours a day of the strain which young children in a small house commonly bring. But it is abundantly clear that formal school lessons of any kind before the fifth year is completed are quite unnecessary. Hygienic surroundings and playful occupations with abundant opportunities for sleep are chiefly wanted. Trained nurses rather than trained teachers, crèches rather than schools, would perhaps meet the situation.

J. A. G.

#### LETTERS TO THE EDITOR.

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#### The Orientation of the Great Temple of Amen-Ra at Karnak.

IN 1891 Sir Norman Lockyer made a magnetic survey of the axis of the great Temple of Amen-Ra, at Karnak, with the view of determining an astronomical date for the original building.

Since that time a great deal has been done in excavating and exposing the foundations of the older work along the temple axis, chiefly under the personal supervision of M. Legrain, of the Department of Antiquities, who for sixteen years has been the director of the explorations at Karnak.

On my recent visit to Karnak, where I spent some weeks, M. Legrain gave me the greatest assistance to enable me to make a resurvey of the axis in the light of the many new discoveries, and particularly in pointing out the parts of the original buildings still *in situ*, many of which he had himself uncovered, and all of which I afterwards measured and centred up.

Unfortunately, I arrived at a very unlucky time for carrying out this work, as the place was crowded with Arab workmen hauling out great stones from the excavations, and gangs of boys carrying baskets of earth from the diggings, all making as much noise as possible, that the place was more like a busy ant-hill than the eternal calm which might be expected in an Egyptian temple. In addition to this, the tourist season was at its height, and personally conducted parties were continually passing up and down, and naturally made a highway of the axis where I had set up my instruments. One soon forgets small inconveniences; but the torment of the insects, when both hands were occupied, is brought to mind by a remark made to me by a passing gentleman from the far West when he said, "Mr. Surveyor, I guess you're having a bully time with them flies."

In the end I managed to peg out a line, down as much of the axis as I could get at, 523 feet long, from the columns in front of the sanctuary down to the lower end of the Hypostyle Hall; unfortunately, both the extremities of the line are blocked up. The sanctuary itself is completely filled up with the huge stones of the fallen roof, and the last columns of the Great Hall at the other end are at present built round with stones and bags of sand on account of the repairs being carried out to the neighbouring pylon, while the pylon itself is timbered up to prevent its falling, so that the two important points for a survey of this part of the axis cannot be used at present.

The line at this end of the axis had to be continued by the theodolite alone, as no measures for centring were possible, as it had to be carried through the *Rameses Pylon* into the Outer Court so far as the standing pillar of *Tirhakah* in order to get the true bearing of the central line by observations of the Pole Star, that star not being visible from any place on the axis inside the buildings.

The result of the survey in general quite confirms the data used by Sir Norman Lockyer in fixing the date at which the original axis was laid down, viz. about 3700 B.C.—a date which M. Legrain fully accepts on the results of his excavations, as the building of the upper end of the temple has been assigned on archaeological grounds to about this period; indeed, two statues have been dug out by him, both now in the Cairo Museum, which give direct evidence as to the date. One is a seated figure of Cheops with his cartouche (of the fourth dynasty), the date of which is given in the lists as B.C. 3733, and the other is a headless figure which has been assigned to the work of the third dynasty. These figures were, of course, dug up long after Sir Norman Lockyer's survey; no older work has been found.

The height of the hills behind which the sun used to set at the summer solstice, to which the temple was oriented, was taken at  $2^{\circ} 30'$ . From the spot I was able to climb up to on the stones filling the sanctuary, to what I thought was about the height of an altar, I made it a little more; but as I had to see the hills through the timbering of the *Rameses Pylon*, between the struts, I could only measure the small part which was not covered; if this is the correct height, as I believe it to be, it would make the date of the foundation a little earlier, possibly to the time of the headless statue, which M. Legrain has assigned to B.C. 4000.

There are a great many difficulties just now in carrying out such an accurate survey as is required to arrive at an astronomical date of any value on account of great work that is being carried on. It must be remembered that the temple is about 1200 feet long, and stands on an area about five times that of St. Paul's, and is divided into numerous halls, corridors, and gateways; but all these are connected by the axis which runs through the whole building from east to west. This axis, when originally laid down, pointed to the place on the hill at which the sun disappeared behind it on the longest day, and the difference between the place where the sun set then and where it sets now gives the date of the foundation of the temple, the rate of the sun's change in declination being known.

M. Legrain tells me that in about two years' time he will have cleared out the fallen roof of the sanctuary, and that by that time he hopes the repairs to the *Rameses Pylon* will be completed and the timbering removed. In that case a unique opportunity will present itself for a survey of the whole of the axis at once from the court behind the opened-out sanctuary right down to the Ptolemaic Pylon at the west; and this Mr. Dowson, the Director-General of the survey in Cairo, has very kindly undertaken to have done by the survey officers so soon as the work is completed.

HOWARD PAYN.

20 Hyde Park Place, W., October 11.

#### A Possible Relation between Uranium and Actinium.

It is believed fairly generally that actinium has its source in the disintegration of uranium, although it is not a member of the direct line of descent through radium. This belief is based mainly on the fact that actinium and its products have a constant ratio to uranium in minerals,

and since this ratio is very small actinium is supposed to be a branch-product.

In *The Philosophical Magazine* for September Mr. G. N. Antonoff describes some experiments in which a new product is obtained, called uranium Y, and gives strong reasons for the view that it is derived, not from uranium X, but directly from uranium. It is always in a small ratio to uranium X. Antonoff has shown that it is probably a branch-product, and a possible origin of the actinium series.

The following considerations may indicate how such a branch-product could be formed. They were not thought worthy of mention until the starting point of a branch-series had been found experimentally. If a single atom of uranium begins to disintegrate, it ordinarily leads to the whole radium series, without disturbance from other atoms. But the molecule of uranium will contain at least two atoms chemically combined, and perhaps a large number. An instability arising in one atom may frequently produce a similar instability in a contiguous atom, or even a projection of one atom into another, so that two atoms may break up together and form new combinations.

The scheduled atomic weight of uranium is 238.5. Two such atoms have a weight 477. If they break up together and form only one substance, it might have a molecular weight equal to that of uranium, or  $\frac{1}{2}$ ,  $\frac{1}{3}$ , . . . of that of the combined atoms. On the assumption that three atoms of a substance are formed, its atomic or molecular weight is 159.

The experiments of Russ appear to give the most trustworthy value of the atomic weight of actinium emanation. They showed that the thorium emanation is 1.42 times as heavy as that of actinium. If thorium emits two  $\alpha$  particles, both helium atoms, its emanation should have an atomic weight about 224. The atomic weight of actinium emanation thus becomes about 156.

On a theory of the constitution of the elements given to the British Association by the writer at Portsmouth, it is more likely that the emanation from thorium has the same atomic weight as that from radium, and that actinium emanation has an atomic weight of 152.5. Russ's experiments would then lead to a value very close to this for actinium emanation. It is, of course, difficult in most cases to obtain satisfactory conclusions from such experiments on diffusion, but there are strong grounds for thinking that in this special case the usual sources of error have been minimised.

If uranium Y be formed in this way, with an atomic weight 159, it may well be the parent of actinium, whether the suggested atomic weight of the emanation be correct or not, and it is not unlikely that at certain stages in the radium series a similar series of branch-products of low atomic weight may be produced. There is evidence of this in the complex product radium C.

J. W. NICHOLSON.

Trinity College, Cambridge, October 11.

#### Hot Days in 1911.

MR. MACDOWALL's letter in *NATURE* of October 12 (p. 485), in which he directs attention to certain features in the sequence of annual number of hot days at Greenwich, is interesting. Nevertheless, I think he himself will acknowledge that his example, viz. the summer of 1911, is a happy one. What his diagram would lead one to expect if one were making a forecast, and not a retrospect, is that the number of hot days in 1911 would lie between his lower limit of 90 days and an upper limit of about 90+130, or 220 days; the value half-way between the two, i.e. 155 days, being the "most probable." Clearly in this case the upper limit, and also the most probable value, may be disregarded, and the lower limit is sufficiently high to be worthy of note.

The fact is that the dot for 1909, the ordinate of which is sought, lies on the lower edge of the boundary of the area of dots, so that in this case the lower limit gives a close approximation to the truth. If a dot happens to lie near the upper edge of the area of dots, the upper limit of its range along the vertical of the diagram becomes a close approximation. But since the difference between the upper and lower limits is no fewer than about 130 days,